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Research Article

Otolith Growth Pattern of *Puntius Schwanenfeldii* from the Koto Panjang Reservoir, Regency of Kampar, Riau, Indonesia

Abstract

Koto Panjang Reservoir is the largest reservoir in Riau Province, there are many efforts of floating net cage (KJA) by using feed (pellet) continuously. As a result of many feeds that settle in the bottom of the waters because it is not consumed by the fish. The purpose of this research is to know the pattern of growth circle otolith of kapiek fish that live around KJA and in waters that there is no KJA (natural). The study was conducted from March to September 2016. This study used survey method, with 5 stations, where St1 and St 2 were in waters without KJA, while St3, St4 and St5 were in the waters around KJA. Taking, grinding and observing the growth circle pattern on otolith cucumber fish were conducted based on the Windarti method (2007). The result of the research shows that there is a difference of growth circle pattern on otolith of kapiek fish between the two public waters. Kapiek fish that live freely around KJA does not have dark circles on its otolith, while kapiek fish in waters without KJA have dark circles on its otolith. Thus the presence of food waste from KJA may affect the growth pattern of kapiek fish in Koto Panjang Reservoir shown in the growth circle pattern in its otolith.

Introduction

Koto Panjang Reservoir is the largest reservoir in Riau Province and functioned as a power plant for the province of Riau. But now these reservoirs have been used as tourist attractions, fishing activities and fish cultivation with floating net cage system (KJA). Most KJA entrepreneurs apply a “semi-intensive” system, which maintains fish in KJA with relatively high stocking density and provides a diet rich in fat and protein to support fish growth [1-3].

The existence of KJA in Koto Panjang Reservoir attracts wild fish to come and approach, such as kapiek fish (Puntius schwanenfeldii), barau fish (Hampala bimaculata), persuasion (*Channa lucius*), fish katung (*Pristolepis grotii*), fish Belida (*Notopterus chilata*) and others [4,5]. The most common fish is kapiek fish. According to [6-8], food scraps that come out of the fish cages attract fish to come around the fish cages, or the food is as an attractant to wild fish outside the *fish cages*. Furthermore, [9] stated that the existence of various types of fish around the *fish cages* is related to the effort to find food, although the food of the fish is different.

Among the species of fish caught in the Koto Panjang Reservoir, the kapiek fish whose diets change, from debris eaters to fish-eating pellets [10]. This shows that only kapiek fish are opportunistic fish [11]. An opportunistic fish is a fish that takes the opportunity to utilize food whenever it is available [10]. Fish that are opportunistic are also able to change the behaviour of foraging behaviour according to the availability of food in which the fish live (Anonymous, 2013). So the existence of *fish cages* can affect the growth of kapiek fish.

The environmental conditions and availability of kapiek fish food resources are an important factor in the availability of kapiek fish stock in nature [12-14] states that if the living environment of fish is still adequate, where the availability of food and environmental conditions support the fish’s life, the fish grows rapidly so that the calcium carbonate ($CaCO_3$) structure accumulated in the bone, as well as otolith, is relatively tenuous. Conversely, if environmental conditions are less supportive of fish life, for example, due to pollution or changes in extreme waters conditions, the fish will experience pressure/stress so that the growth of fish becomes disturbed/obstructed [15]. As a result of this slow growth, the structure of $CaCO_3$ accumulated in otolith is formed relatively dense. The loose structure of $CaCO_3$ appears as a light/thin growth circle, while the solid $CaCO_3$ structure appears as a dark/thick growth circle [16,17].

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In Koto Panjang Reservoir there are many fish cultivation activities in the *fish cages*. The fish are fed in the form of commercial pellets continuously and feeding is only stopped when the fish is not willing to eat. As a result of this way of feeding, much of the residual feed is not eaten by aquaculture fish and is scattered out of the *fish cages*. The rest of this feed is used by wild fish, including kapiek (*P. schwanafeldii*). While the commercial fish pellets are wasted out of *fish cages* is a source of nutritious food for wild fish. By consuming this pellet, it is estimated that the fish that live around the *fish cages* get an adequate food so it can grow well. The pattern of fish growth is reflected in the growth circle pattern in the otolith of the fish.

Kapiek fish can take advantage of fish pellets that come out of *fish cages* as the main food. In fish that live around the *fish cages*, the contents of the stomach are mainly pellet fish [10]. It is estimated that the fish kapiek around the *fish cages* is growing well. This is different from the kapiek fish that live in an area where there are no *fish cages*, so the fish do not get additional high nutritious food. Thus, the growth of this kapiek fish will be different from the growth of kapiek fish that is around *fish cages*. To know the difference of growth pattern of kapiek fishes that live around *fish cages* and in the area there are no *fish cages*, then the research about Growth Circle Pattern in Otolith Kapiek Fish (Puntius schwanafeldii) In Koto Panjang Reservoir Kampar Regency, Riau.

Materials and Equipment

Time and place

The research was conducted in March-September 2016 in Koto Panjang Dam and Kampar River as sampling location. The sample analysis was conducted in the Laboratory of Water Ecology and Integrated Laboratory of the Faculty of Fisheries and Marine, Riau University, Pekanbaru.

Materials and tools

The materials used in this study are kapiek fish derived from Koto Panjang hydropower reservoir directly from the catch of fishermen. The tool used for otolith observation can be seen in table 1.

Table 1: Tools used for research

No	Tools name	Function
1	Gill net	Tool for catching fish
2	Motor boats	for transportation
3	GPS	To determine the position of the research station
4	Cool Boxes	Stone fragments preserve fish temporarily
5	Dissecting microscope	Observe fish in detail
6	Freezer	To store fish samples
7	Label paper	To name the fish
8	Plastic trays	Fish containers during analysis
9	Rough Grindstone	To hone a large otolith
10	Smooth grindstone	To hone a small otolith11
11	Object glass	For a well-honed otolith
12	Digital camera	For shooting

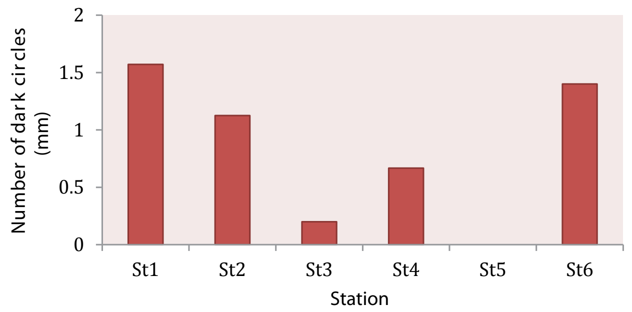

Figure 1: Number of Growth Rings on Otolith Kapiek Fish *(P. schwanenfeldii).*

Table 2: Number of dark circles and distance from the nucleus to first dark circle on otolith of kapiek fish (*P. schwanenfeldii*).

Station	Distance from core to dark circle first (mm)	Number of dark circles
St1	0,49	1,6
St2	0,45	1,1
St3	0,33	0,2
St4	0,49	0,7
St5	0	0
St6	0,45	1,4

Result and Discussion

The existence of different nutritional content in kapiek fish food can affect the growth pattern of fish. This can be seen by the difference in growth circle pattern in otolith of kapiek fish that live freely around KJA and in areas where there is no KJA. Based on the result of research about growth circle pattern in otolith of kapiek fish there is the difference in natural area and area around KJA. In kapiek fish that live freely around KJA, there is no dark circle in otolith, while kapiek fish that is in the natural area there is a dark circle on its otolith (Table 2 and Figure 1).

Research methods

The method used in this research is survey method, that is Koto Panjang Reservoir and Kampar River used as the location of kapiek fish sampling for research of growth circle pattern in otolith.

Determination of the station

The study sites were established based on the distribution of KJA distribution and KJA density in long Koto Reservoir. Station 1, 2, 3 and 4 are located in an area with *fish cages*. While station 5 is an area with no *fish cages*. Station 6 is a *fish cages* used for raising kapiek fish but the fish are never fed (without pellets).

Data collection technique

Fish sample data were collected through direct observation to the field in accordance with established stations and research stages. Sampling is done as follows:

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Sampling fish

Fish sampling is done by catching fish samples directly from five research stations that have been established. The fishing gear that will be used is gill net with size 150 x 4m; (mesh size 4 inch) and gill net with size 100 x 3 m (mesh size 3 inch). Fish sampling is done by census if the number of fish caught (per species) is less than 10 tail and the sampling is done by sampling if the number of fish caught more than 10 tail at each station and observation.

Observations and measurements on otolith

Otolith lies in a cavity beneath the brain. Otolith bone is taken from the ventral. The sampled fish is cut or torn between the bones of the head and body, then the head is bent toward the dorsal until between the head bone and the spine is broken. After that, the gills and the existing tissue of the mouth of the fish are thrown until the bones are visible white milk of milk which amounts to a pair (left and right). The otolith is taken by using small size tweezers to avoid breaking the otolith. Then Otolith is cleaned with bleach solution for 5 seconds to clean the remaining tissue, then washed with water then dried with tissue and put in a labelled plastic. Otolith has been obtained, then measured using a microscope. Then the otolith was weighed using Sartorius scales with the accuracy of 0.0001 g. Otolith placed on the scales that have been measured before and see how many figures listed on the scales so we can know how much otolith fish samples.

The working procedure in making otolith preparations are as follows:

Firstly, prepared dry otolith and Crystalbond grains.

Next crystal bond placed on glass object, then heated with the hot plate with temperature 40°C - 60°C. After Crystallbond melts then the otolith is placed slowly on the glass object.

When putting the otolith on Crystallbond, there is no air bubble in crystalloid so that the otolith can be seen clearly during observation under the microscope.

After cool or hardened, samples are honed using rough grindstones. Sharpening is done in a tray that contains water for the otolith not to be scratched. The otolith is sharpened until the growth circle is first seen. Then resumed with second grinding using a soft grindstone until the circle growth pattern is clearly visible.

Result and Discussion

The existence of different nutritional content in kapiek fish food can affect the growth pattern of fish. This can be seen by the difference in growth circle pattern in otolith of kapiek fish that live freely around KJA and in areas where there is no KJA. Based on the result of research about growth circle pattern in otolith of kapiek fish there is a difference in natural area and area around KJA. In kapiek fish that live freely around KJA, there is no dark circle in otolith, while kapiek fish that is in the natural area there is a dark circle on its otolith (Table 2 and Figure 1).

The results showed that the kapiek fish living on St5 had no dark circles in otolith. Suspected because St5 is an area that there are many KJA. The presence of this KJA causes the number of foods with high nutrients that result in kapiek fish can grow well. When fish grow well, otolith also enlarge rapidly, along with the growth of fish. Food that comes from KJA is available continuously, not depending on the season so that the kapiek fish that eat the rest of the pellet also grows constantly. The existence of this constant growth resulted in the density of Calcium Carbonate deposited in otolith evenly and no dark circles formed.

At St3 and St4 stations, there is little KJA (80-236 units). In addition, KJA location with one another is relatively far

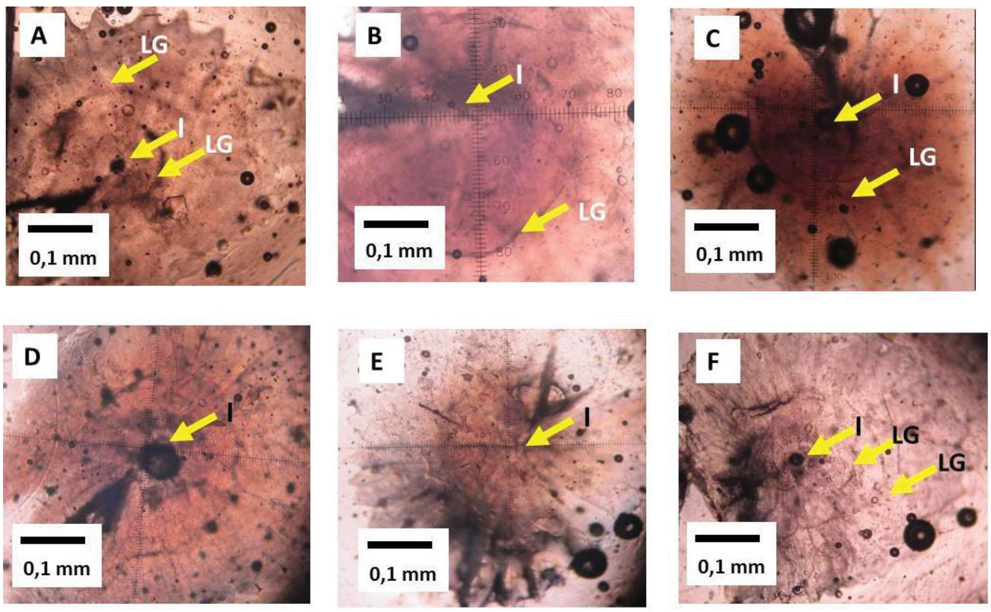

Figure 2: Number of Growth Rings on Otolith Kapiek Fish *(P. schwanenfeldii).*

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away. The minimal amount of KJA and the distance between KJAs leads to low pellet concentrations in surrounding waters so that the availability of food for free-living kapiek fish in the area is relatively small. In this area, the harvest is done simultaneously, after KJA harvest is cleaned and left empty about 2-4 weeks. In the absence of fish cultivation intake of food derived from KJA also does not exist, so the fish depends only on the food available in nature. The absence of food derived from this KJA resulted in a change in the rate of growth of kapiek fish that used to consume food from KJA. The growth of the kapiek fish is slower and is estimated to be seen in the appearance of thin dark circles in otolith (Figures 1,2).

The samples of fish from St6 are fish kept in KJA but not fed. These fish are the fish found in the KJA at the time of the cultivation fish harvest. It is estimated that kapiek fish enter into KJA as a child, then live and grow in the KJA along with fish cultivation. Farmers consider this fish as a pest because it is a rival for aquaculture fish in getting food and space. Because kapiek fish have a relatively less high price (Rp 8.000, - 15.000, - / kg) then the fish is only kept in KJA and not fed especially. As a result, the growth rate of kapiek fish is slower than the growth rate of the fish while still alive in KJA. This relatively slow growth rate is indicated by the appearance of dark circles at a distance of about 0.45 mm from the core (Figures 1,2). This suggests that food availability is associated with the formation of dark circles in otolith fish.

In St1 and St2 kapiek fish only eat natural foods without any residual intake of pellets from KJA. Since natural foods contain fewer nutrients than artificial feed and the availability of natural foods is irregular, the growth of kapiek fish in St1 and St2 is relatively slower than the growth of fish at other stations. This is also reflected in the appearance of dark circles in otolith fish.

Information

I: Core	LG: Dark Circle	A: St1	B: St2
C: St3	D: St4	E: St5	F: St6

The results of this study indicate a difference in the pattern of growth circles in otolith in kapiek fish. In kapiek fish that never get access to food from KJA that is kapiek fish in Kampar River and reservoir area that there is no KJA, dark circle formed on otolith saw clearly. Whereas in kapiek fish that easily get access to food derived from the remaining pellets coming out of KJA, the growth circle is less clear or absent [18,19] (Campana, S. E., 2005). According to Lagler et al. (1977) and Effendie (2002), the dark/dense growth circle lines form when the growth cycle is slow, while the thin/light growth circle is formed when the fish experiences rapid growth. It is assumed that there are differences in growth rate of kapiek fish in this study. Kapiek fish that get little food from KJA have dark growth circles in its otolith. Whereas in kapiek fish that get food from KJA do not have a dark circle or have unclear growth circle. This indicates the presence of food waste from KJA can affect the growth pattern of kapiek fish in Koto Panjang Reservoir which is depicted on the growth circle pattern in otolith. According to [16,17] that the pattern of growth circles on otolith is influenced by environmental conditions and physiological conditions of fish. In addition, the growth circle in otolith fish is influenced by the availability of food [20,21]. This indicates that the remaining feed is wasted as an attractant for kapiek fish and causes changes in growth pattern in kapiek fish.

Conclusion

Fish that live in the *fish cages* do not have dark circles in its otolith. This shows that the fish get good nutrition and grow well too. While fish from areas that do not have *fish cages* and fish are kept in *fish cages* but never fed grow slowly, so in this otolith formed a dark circle.

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